

Claim 47. An apparatus in accordance with Claim 46, which comprises a rail, said transport vehicle movable along said rail.

Claim 48. An apparatus for automatically detaching and displacing animal feed for consumption by animals which comprises a plurality of containers, each said container containing a different animal feed, a plurality of troughs for receiving said animal feed from said containers, a robot arm which is constructed and arranged to move said animal feed from at least one of said containers to at least one of said troughs, said robot arm comprising detaching means for detaching a portion of said animal feed from said animal feed in said one container and displacing means for selectively displacing said portion of animal feed to said trough and depositing said portion in said trough, said detaching means essentially consisting of a gripping element or a bucket or a shovel.

IN THE ABSTRACT:

In lieu of the Abstract set forth on page 10 of the original Application, please substitute the Abstract of Disclosure appended hereto.

REMARKS

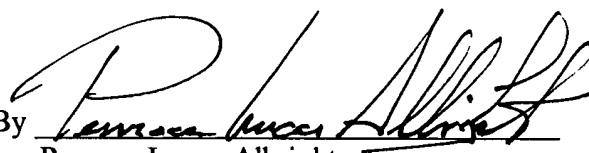
The purpose of this Preliminary Amendment is: (1) To provide a Substitute Specification and an Abstract which are in formats customary for U.S. patent applications and which are also expressed in less stilted and more readable idiomatic English; (2) To amend the claims of this Application to eliminate multiple-dependent claims therefrom; (3) To establish a filing fee; and (4) To amend the claims so that they are more nearly in a style and formats customary for U.S.

patent applications. It is to be understood, nevertheless, that the claims originally set forth remain part of the original disclosure of the Application.

As amended, the Application has twenty-nine (29) claims, three (3) of which are independent claims. Accordingly, a filing fee of \$436.00 appears to be required and our check to cover same is submitted herewith. If this is in error, the Commissioner of Patents and Trademarks is authorized to debit or credit our Account No. 13-2000 as appropriate.

Respectfully submitted,

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AN IMPLEMENT FOR AUTOMATICALLY DETACHING AND DISPLACING AN
AMOUNT OF FEED, SUCH AS FOR EXAMPLE SILAGE OR HAY

FIELD OF THE INVENTION

The invention relates to an ~~implement~~ ^{apparatus} for

- 5 automatically detaching and displacing an amount of feed, such
as for example silage or hay, from a stock of feed, said
~~apparatus~~ ^{apparatus} being provided with a robot arm with a detaching
member which is suitable for detaching a part of the feed from
the stock, ~~and~~ displacing it to a predetermined place and
10 depositing it there. Such an ~~implement~~ ^{apparatus} has the advantage that,
in a simple manner, a measured out amount of feed, in
particular fodder that is difficult to handle, such as silage
or hay, can be detached from a stock of feed and be displaced
to a predetermined place. In particular in relation to ~~the~~
15 known constructions, in which for example an auger is used,
the above-mentioned ~~implement~~ ^{apparatus} has the advantage that with the
aid of the robot arm various stocks of feed can simply be
reached by the robot arm with the detaching member.

SUMMARY OF THE INVENTION

- ~~According to a further inventive feature~~ The
20 ~~detaching member~~ ^{according to the invention} comprises a gripping element. ~~The gripping~~
~~element~~ ^{which} has the advantage of being less sensitive to clogging, ~~and~~
~~a gripping element~~ has the further advantage of making it
possible for example to detach a tuft of hay from a bale of
hay.

- 25 In a preferred embodiment of the invention, the
detaching member comprises a bucket or a shovel. By means of
the bucket or the shovel it is in particular possible to
detach in a simple manner blocks of concentrate from a stock
of feed.

- 30 According to another inventive feature, the detaching
member is capable of being closed. Especially when granular or
pulverulent material has to be detached from a stock of feed,
it is of importance that the detaching member can be closed
for the purpose of preventing loss of feed during transport.

- 35 In order to prevent the detaching member from being
contaminated, the robot arm is provided with cleaning ~~and~~ or
brushing means ^{or both} for the detaching member. In a preferred

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embodiment of the invention, the cleaning ~~and~~ or brushing means, ^{or both,} comprise a sweeping element. For the purpose of being able to detach from the stock a previously measured out portion of feed, the ~~implement~~ ^{apparatus} comprises metering means.

5 ~~implement~~ ^{apparatus} According to again another inventive feature, the ~~implement~~ comprises weighing means for weighing said portion of feed. According to a further inventive feature, the robot arm comprises the weighing means. In order to be able to determine where and when a particular amount of feed can be
10 deposited by the robot arm with the detaching member, the ~~implement~~ ^{apparatus} comprises animal identification means, with the aid of which an animal can be identified. According to a further inventive feature, the animal identification means are fitted on the robot arm. This ~~arrangement~~ has the advantage that, for
15 example in the situation that a feeding column with various feeding troughs is used, it is not necessary to provide each feeding trough with animal identification means.

~~implement~~ ^{apparatus} According to a further inventive feature, the ~~implement~~ comprises at least one ^{trough for} feeding ~~and~~ or watering ^{apparatus, or both.}
20 ~~trough~~ ^{or both.} According to another inventive feature, the ~~implement~~ comprises at least one container for storing the fodder ~~and~~ or drink. In a preferred embodiment of the invention, the robot arm is disposed above ^{trough which is for} the feeding ~~and~~ or watering ^{or both} trough and ~~over~~ above the container. According to again another
25 inventive feature, the ~~implement~~ ^{apparatus} is provided with a chute via which the feed can be discharged to a relevant feeding ~~and~~ or watering trough. ^{or both} In an embodiment of the invention, the robot arm has such dimensions that the detaching member can move over ~~and~~ or along the bottom of the container ~~and~~ or the
30 feeding ~~and~~ or watering trough. ^{or only one of them} Thus it is possible to take the last remnants of feed from the container or the trough. In order to be able also to use the robot arm for example in a loose house, the robot arm is at least movable over the floor of the stable. In a preferred embodiment of the invention, the
35 robot arm is movable along a rail. It will be obvious that it is also possible to dispose the robot arm for example on belts, such as caterpillar tracks, and to move it in this

manner through the stable. According to again another embodiment of the invention, the ~~implement~~ ^{apparatus} comprises one or more transport vehicles that co-operate with the robot arm. Thus it is possible, for example in a stable, to convey by means of the transport vehicles the feed that has been detached to a particular place and to deposit it there. In a preferred embodiment of the invention the transport vehicles are movable along a rail. The above-mentioned ~~implement~~ ^{apparatus} can in particular be applied in a feeding column with various feeding ^{or watering} ~~and/or~~ watering troughs, to which the animals are allowed to

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be explained in further detail with reference to the accompanying drawings, in which:

Figure 1 is an ^{elevation} ~~an~~ cross-section of the ~~implement~~ ^{apparatus} according to the invention;

Figure 2 is a second embodiment of an ~~implement~~ ^{apparatus} according to the invention, and

Figure 3 is a plan view of a loose house in which a third embodiment of the ~~implement~~ ^{apparatus} according to the invention is depicted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 is a cross-section of an ~~implement~~ ^{apparatus} 1 for automatically detaching and displacing an amount of feed. ~~The~~ ^{Implement} 1 is provided with a robot arm 2 with a detaching member 3 which is suitable for detaching feed from containers 4 that are integrated in a feeding column 5. The feeding column 5 comprises ^{troughs 7 for} ~~feeding and/or watering troughs~~ ^{or both} 7, that are disposed around a central axis 6 and from which animals, such as cows for example, can eat ~~and/or~~ ^{or both} drink. Each ~~of the~~ feeding trough 7 is capable of being closed separately by means of a closing member 8 which is ~~constituted by~~ a lid in the present embodiment. Under each ~~of the~~ feeding trough 7 ~~there~~ is disposed a load cell 9 with the aid of which the weight of a relevant feeding trough can be determined. As shown in Figure 1, the robot arm is arranged centrally above ~~the~~ containers 4. This measure has the advantage that ~~the~~ robot arm 2 with ~~the~~

detaching member 4 can reach in a simple manner all ~~the~~ containers 4, as well as ~~the~~ feeding troughs 7. ~~The~~ Robot arm 2 is also provided with a weighing device 10 which is designed as a load cell in the present embodiment. By means of ~~the~~ weighing device 10 it is possible to determine each time how much feed is taken from a container 4 and deposited in a particular feeding trough 7. ~~The~~ Robot arm 2 is further provided with a first stepper motor 11 with the aid of which ~~the~~ robot arm 2 can be rotated about a vertical axis 12. ~~The~~ Robot arm 2 is further provided with two further stepper motors 13 with the aid of which ~~the~~ robot arm 2 can be positioned in the vertical plane. The end of ~~the~~ robot arm 2 comprises a telescopic cylinder 14. In the present embodiment ~~the~~ detaching member 3 is designed as a gripper 15 with the aid of which feed can be seized and be released. Near ~~the~~ detaching member 3 there is further disposed an animal identification system 16 which makes it possible to recognize an animal that is standing near one of ~~the~~ troughs 7. By means of the animal identification system 16 and a ~~(non-shown)~~ computer it can thus be determined whether or not an animal that is waiting near a feeding trough 7 will be fed. Upon feeding the animals it is possible to compose a meal of feed from various containers 4 for a relevant animal. The gripper is particularly appropriate when roughage, such as for example silage or hay, has to be taken from a container 4. It will be obvious that it is also possible, of course, when remnants of feed are still present in ~~the~~ feeding troughs 7 after a particular animal has eaten there, to take these remnants back by means of ~~the~~ robot arm 2 and to displace them to a relevant container 4 and deposit them there.

Figure 2 shows a second embodiment of an ~~embodiment~~ ^{apparatus} 1 for automatically detaching and displacing an amount of feed from a container 4 of a ~~(not completely depicted)~~ feeding column 5. ^{which is not completely depicted in Figure 1.} In the present embodiment ~~the~~ robot arm 2 is differently designed than ~~the~~ robot arm 2 according to Figure 1. However, corresponding parts are indicated by the same reference numerals. By means of ~~the~~ upper stepper motor 13 it

is possible to move ~~the~~ detaching member 3 along the curved lines of ~~the~~ container 4, while the lower stepper motor 13 makes it possible to move the entire robot arm 2 upwards or downwards. To allow the latter movements, ~~the~~ robot arm 2 comprises a quadrangular pivot construction 17. In the present embodiment ~~the~~ detaching member 3 comprises a bucket 18 which is disposed at the end of ~~the~~ robot arm 2. With the aid of ~~the~~ bucket 18 feed can be scooped from ~~the~~ container 4. By means of a closing mechanism 19 it is possible to close ~~the~~ bucket 18 after the latter has been filled completely, so that feed is prevented from falling from the bucket during transport. For that purpose ~~the~~ closing mechanism 19 comprises a closing lid 20 which is connected by means of a steering rod 21 to a stepper motor 22 which, after having been energized, causes ~~the~~ bucket 18 to be closed or opened. ~~the~~ Closing mechanism 19 is further coupled with cleaning means 23 that ~~is~~ moved along the bottom ~~and/or~~ along ~~the~~ walls of ~~the~~ bucket 18 ^{or both} during opening ~~and/or~~ closing of said bucket 18. For that purpose ~~the~~ cleaning means 23 comprise a brushing element 24. When ~~the~~ bucket 18 has been filled completely, said bucket 18 is moved by means of ~~the~~ robot arm 2 to a chute 25 where the feed is poured into ~~the~~ chute 25 by activating ~~the~~ closing mechanism 19. Via ~~the~~ chute 25 the feed is poured into a predetermined ~~and not further shown~~ feeding trough, such as ~~the~~ feeding trough 7 in Figure 1. By means of ~~torque~~ measurements on the stepper motors 11 ~~and/or~~ 13, it is possible to determine whether the bucket is full or empty ^{while removing} ~~and/or~~ detaching feed from ~~the~~ containers 4. ~~It will be obvious that the~~ ^{apparatus} ~~embodiment~~ according to Figure 2 can be completely integrated in ~~the~~ feeding column 5 as shown in Figure 1.

Figure 3 is a plan view of a stable 26 with a third embodiment of an ~~apparatus~~ ^{apparatus} 1 according to the invention arranged therein. ~~The~~ ^{for} stable 26 comprises two rows of feed stands/cubicles 27 and at the end thereof two storage areas 28 for storing roughage ~~and/or~~ ^{or both} concentrate. ~~The~~ ^{or both} storage areas 28 each comprise a plurality of containers ^{or both} 4 for storing various ^{categorized} ~~types~~ of fodder ~~and/or~~ ^{or both} drink. ^{or both} ~~between the two rows of feed~~ ^{2nd row is disposed}

stands 27 and ~~the~~ storage areas 28 ~~there is disposed a rail 29~~
 along which a transport vehicle 30 ~~can be moved~~ automatically
 under computer-control. By means of ~~the~~ robot arm 2, feed can
 be deposited from a container 4 into ~~the~~ transport vehicle 30
 5 by means of ~~the~~ detaching member 3. ~~the~~ Robot arm 2 of ~~the~~
 10 ~~implement 1~~ ^{of Figure 1} in Figure 1 may be designed as the robot arm in
 Figure 1 or Figure 2. ~~the~~ Robot arm 2 is also automatically
 movable under computer-control along the rail 29. With the aid
 of ~~(non-shown)~~ animal identification means it is thus possible
 to convey feed to a predetermined feed stand ^{of a cubicle} ~~stand~~ by means of
 10 ~~the~~ robot arm 2 and ~~the~~ transport vehicle 30. ~~It will be~~
 obvious that ~~It~~ is also possible to arrange a stationary robot
 arm 2 between ~~the~~ storage areas 28 and to convey ~~the~~ feed to a
 particular place only by means of ~~the~~ transport vehicle 30.

although we have disclosed the preferred
 embodiments of our invention, it is to be understood
 that it is aspects of other adaptations and modifications
 within the scope of the following claims.